MULTIMEDIA UNIVERSITY

STUDENT ID NO

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# MULTIMEDIA UNIVERSITY

# FINAL EXAMINATION

**TRIMESTER 1, 2017/2018**

## PCM0235 - CALCULUS

(Foundation in Information Technology/ Foundation in Life Sciences)

14 OCTOBER 2017
2.30p.m – 4.30p.m
(2 Hours)

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**INSTRUCTIONS TO STUDENT**

1. This Question paper consists of 2 pages excluding the cover page and appendix.
2. Answer **all FIVE** questions. Each question carry equal marks and the distribution of the marks is given.
3. Write all your answers in the Answer Booklet provided.

**Answer All Questions.**

**Question 1 (10 marks)**

a) Find the following limits.

i. $\lim_{x\to 0}\frac{\sin^2 5x}{8x^2}$ (3 marks)

ii. $\lim_{x\to-\infty}\frac{5x^3+2x^2}{x^2+x+7}$ (2 marks)

iii. $\lim_{x\to 1}\frac{\sqrt{x+4}-\sqrt{5}}{x-1}$ (3 marks)

b. A function $f(x)$ is given as $f(x)=\begin{cases}\frac{x^2-4}{x-2}, & x<2\\ kx+5, & x\geq 2\end{cases}$.

Determine the value of $k$ such that the function is continuous for all real numbers. (2 marks)

**Question 2 (10 marks)**

a) Find the first derivative given:

i) $y=(3x^2-2)(4x^3+1)^3$. (3 marks)

ii) $y=\frac{x^3}{\tan 8x}$. (3 marks)

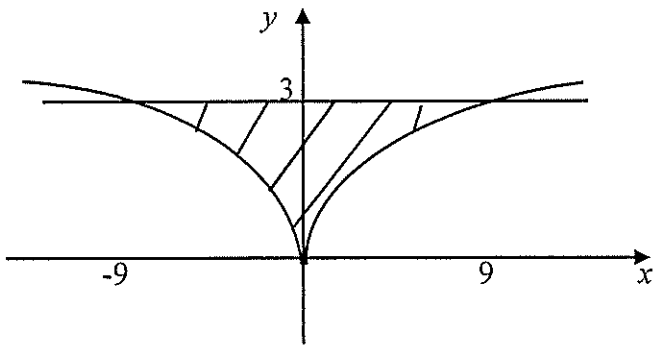
b) Find the equation of the tangent line to the curve $y=\ln(2x^2+ex)$ at the point $x=2e$. (4 marks)

**Question 3 (10 marks)**

a) Find the local maximum, local minimum, interval of increasing and interval of decreasing for the function $f(x)=x^4-4x^3+4x^2$. (5 marks)

**Continued...**

b) Let R the region bounded by $y=\sqrt{x}, y=\sqrt{-x}$ and $y=3$ is given below.




Find the area of region R. (5 marks)

**Question 4 (10 marks)**

a) Solve the given first order differential equation, $\frac{dy}{dx}-2y=4.$ (4 marks)

b) Solve the given second order differential equation.

$$y''-6y'+9y=0,\quad y(0)=2, y'(0)=-1.$$ (6 marks)

**Question 5 (10 marks)**

a) Evaluate:

i. $\int\left(\frac{x^2-4x-5}{x+1}+\sin 3x\right)dx.$ (3 marks)

ii. $\int_0^2 3x^2 e^{6x^3}\,dx.$ (2 marks)

b) Use integration by part to evaluate $\int x^2\cos x\,dx.$ (5 marks)

**End of Page**

## APPENDIX

### A. Differentiation Rules

$\frac{d}{dx}[x^n] = nx^{n-1}$ ; $n$ is any real number

$\frac{d}{dx}[f(x).g(x)] = f(x)g'(x) + f'(x)g(x)$ ; The Product Rule

$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - f(x)g'(x)}{[g(x)]^2}$ ; The Quotient Rule

$\frac{d}{dx}[f(g(x))] = f'(g(x)).g'(x)$ ; The Chain Rule

$\frac{d}{dx}[g(x)]^n = n[g(x)]^{n-1}.g'(x)$ ; The power rule combined with the chain rule:

$\frac{d}{dx}[\sin x] = \cos x$ $\quad$ $\frac{d}{dx}[\cos x] = -\sin x$ $\quad$ $\frac{d}{dx}[\tan x] = \sec^2 x$

$\frac{d}{dx}[\sec x] = \sec x \tan x$ $\quad$ $\frac{d}{dx}[\cot x] = -\csc^2 x$ $\quad$ $\frac{d}{dx}[\csc x] = -\csc x \cot x$

$\frac{d}{dx}[e^x] = e^x$ $\quad$ $\frac{d}{dx}[\ln x] = \frac{1}{x}; \quad x > 0$

### B. Basic Integration Formulas

$\int cf(x)\,dx = c\int f(x)\,dx$ $\quad$ $\int k.dx = kx + C$

$\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)dx$ $\quad$ $\int x^n dx = \frac{x^{n+1}}{n+1} + C, \quad n \neq -1$

$\int e^x\,dx = e^x + C$ $\quad$ $\int \frac{1}{x}dx = \ln|x| + C$

**Integration by-parts:** $\int u\,dv = uv - \int v\,du$

**Volume (disk)** $= \pi\int_a^b (f(x))^2\,dx$ $\quad$ **Area** $= \int_a^b (f(x) - g(x))dx$

**Volume (washer)** $= \pi\int_a^b \left[(f(x))^2 - (g(x))^2\right]dx$